PHYSICAL ACTIVITY REDUCES BREAST CANCER RISK IN AFRICAN AMERICAN WOMEN

Vanessa B. Sheppard, PhD; Kepher Makambi, PhD; Teletia Taylor, PhD; Sherrie Flynt Wallington, PhD; Jennifer Sween, MS; Lucile Adams-Campbell, PhD

Objective: To examine the relationship between physical activity and breast cancer in African American women.

Design: A population-based case-control study was conducted with 199 women (97 cases and 102 controls) from the Washington, DC metro area. A physical activity questionnaire elicited responses on frequency of walking for exercise and vigorous physical activity (eg, running, aerobics) in the past year. Responses were used to calculate a metabolic equivalent (MET) score (MET-hours/week = hours/week vigorous activity × 7 + hours/week walking × 3). The MET score was categorized into low, medium, and high tertiles. Multivariate logistic regression examined the association between physical activity and breast cancer.

Results: African American women who engaged in vigorous physical activity (≥2 hours/week in the past year) had a 64% reduced risk of breast cancer compared to those who did not participate in any vigorous activity (odds ratio, OR = .36; 95% confidence interval, CI = .17–.75). We also found a 64% reduced breast cancer risk in women with a high vs low tertile of total activity (OR = .36; 95% CI = .16–.79). For postmenopausal women, vigorous physical activity and total activity (high vs low tertile) also had an inverse relationship with breast cancer ($P<.05$).

Conclusion: Data regarding the association of physical activity and breast cancer have been equivocal and lacking for African American women. This study found that modest levels of physical activity reduced breast cancer risk in this group. Targeted efforts are needed to encourage more African American women to engage in physical activity. (*Ethn Dis*. 2011;21(4):406–411)

Key Words: Total Activity, Blacks, Postmenopausal, Women

From Lombardi Comprehensive Cancer Center, Georgetown, University, Washington, DC (VS, KM, SFW, JS, LA-C) and Howard University Cancer Center, Washington, DC (TT).

Address correspondence to Vanessa B. Sheppard, PhD; Lombardi Comprehensive Cancer Center; Cancer Control; 3300 Whitehaven Street, NW; 4100 Harris Building; Washington, DC 20057; 202.687.7036; 202.687.0305 (fax); vls3@georgetown.edu

INTRODUCTION

Breast cancer is the leading cancer diagnosed in US women. Although more than 190,000 cases are diagnosed each year, there are few prevention strategies.[1] Known risk factors, such as genetic mutations and family history of cancer, account for only 30% of a woman's risk for being diagnosed with breast cancer.[1] Thus, lifestyle changes may reduce a woman's breast cancer risk. Research suggests that an increase in physical activity, in particular, among sedentary, postmenopausal women changes their hormone levels to reflect a lower risk of breast cancer diagnosis.[2] Therefore, physical activity may be one of the best approaches toward the primary prevention of breast cancer.[2–4]

The relationship between physical activity and breast cancer risk is complex and may be explained by certain molecular mechanisms. It is plausible that physical activity could affect breast cancer risk because it also affects other risk factors, such as menstrual cycle, body mass, immune system, and hormones such as insulin-like growth factor (IGF).[3–6] It is well accepted that physical inactivity increases one's risk of obesity. Obesity is also considered to be a breast cancer risk factor, and there is an inverse relationship between obesity and physical activity.[7] How physical activity and obesity might confound each other is unknown; obesity is positively associated with breast cancer risk in postmenopausal women but inversely associated with risk in premenopausal women.[8] Further, some data suggest that adult weight gain, rather than body mass index (BMI), affects breast cancer risk, especially among non-users of hormonal replacement therapy.[9]

Studies have shown a relationship between obesity and the risk of breast cancer but in samples of mostly Caucasian women.[10,11] Data, although equivocal, suggests that physical activity is inversely related to breast cancer risk in both premenopausal and postmenopausal women.[2]

African American women have the highest rates of obesity than other racial/ethnic groups in the United States.[12,13] They are also more likely to be overweight, obese, have a higher BMI and have a higher waist-to-hip ratio than Caucasians.[12,13] Further, more than 50% of African American women aged ≥40 years are obese and more than 80% are overweight.[14] Coupled with the excessive breast-cancer burden in African American women, physical inactivity may be an important modifiable risk factor. More research is needed to determine whether moderate and/or vigorous levels of physical activity can reduce breast cancer risk in this population. The objective of this study was to examine the relationship between physical activity and breast cancer among African American women. Specifically, we tested the hypothesis that breast

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cancer risk would be lower in women with higher levels of physical activity controlling for BMI, demographic factors, and clinical factors.

METHODS

We employed a case-control study to assess the impact of physical activity on breast cancer risk. Study approval was obtained from Institutional Review Boards at Georgetown University Medical Center and Howard University in Washington, DC.

Cases

All cases recruited in this study were African American women born in the United States, residing in the Washington, DC metro area, and diagnosed with breast cancer at participating cancer centers. Eligible women had a working home telephone and were able to communicate in English. Severely ill or institutionalized women were excluded from the study. Also, ineligible women were those suffering from drug abuse or unable to give informed consent. After the initial identification of the cases from the surgical schedules, and the confirmation of diagnosis via pathology reports, consent was obtained from the surgeon to contact patients. Newly diagnosed patients were recruited over a six-month period and contacted by a formal invitation letter and follow-up telephone call to discuss their willingness to participate in the study, confirm eligibility, and schedule an interview; 70% participated. The final sample included 97 cases (unilateral or bilateral).

Controls

Population controls were randomly selected from a District of Columbia voter registration list obtained from the District of Columbia Board of Election. The controls were contacted by an invitation letter followed by a telephone call to discuss the study and willingness to participate. Upon receiving verbal consent, an interview was scheduled. On the day of the interview, participants read and signed consent forms and completed the same survey as the cases, after which a blood sample was drawn. Eligibility criteria were the same as those for the cases except that the controls must have had no personal history of breast cancer. Approximately 52% (115/221) of the controls were successfully contacted and enrolled in the study; 46% completed the study.

Data Collection

Trained interviewers administered a structured questionnaire that included demographic measures, anthropometric measurements, physical activity, weight, height, menopausal status, family history of breast cancer, age at menarche, age at first full-term birth, education, and income.

All exposure information was collected when women entered the study. Physical activity was measured using validated self-report items drawn from other studies, (eg, Women's Health Study).[15,16] Respondents answered questions about how many hours per week they spent on vigorous physical activity (eg, basketball, swimming, running, and aerobics) during the past year for both cases and controls. The response categories were none, <1, 1, 2, 3–4, 5–6, 7–9, or ≥ 10 hours per week. Participants were also asked how much time they spent per day during the past year walking for exercise. The responses were also given as none, <1, 1, 2, 3–4, 5–6, 7–9, or ≥ 10 hours per day. These categories were further reduced to none, <2, or ≥ 2 hours per week (per day) for vigorous physical activity and walking for exercise. To investigate total time spent in vigorous physical activity and walking for exercise, a MET (metabolic equivalent) score was used and calculated as (MET-hours/week = hours/week vigorous activity $\times$ 7 + hours/week walking $\times$ 3). The MET score was then categorized into low, medium, and high tertiles.

Statistics

Differences between cases and controls on continuous and categorical variables were tested by Student's t test and Pearson's χ^2 test. Unconditional multivariate logistic regression models were used to compute odds ratios (ORs) and the corresponding 95% confidence intervals (CIs). To choose covariates to include in the final model, we fitted logistic regression models involving each predictor variable in Table 1 and the physical activity exposure variable(s). Any variable that was significant at the .25 level was retained in the final model. Education and income were retained as covariates because they have been found to be important in other studies of physical activity. Thus, the covariates retained and therefore adjusted for in the final model included age (continuous), marital status, menopausal status, BMI (continuous), family history of breast cancer (yes/no), age at menarche (≤ 12, >12), age at first full-term birth (nulliparity, <20, 20–24, ≥ 25+), education (less than high school, high school or above), and income ($<\$30{,}000$, $\geq \$30{,}000$ annually). Additionally, we adjusted for walking for exercise (vigorous activity) whenever vigorous activity (walking for exercise) was the exposure of interest. Analyses were done separately for premenopausal and postmenopausal women. Analyses were conducted using SAS software, release 9.1; the significance level was set at .05.

RESULTS

As shown in Table 1, cases were significantly older than controls (t test, $P = .002$), and a higher proportion were married (χ^2-test, $P = .003$). Compared with controls, the mean BMI for cases was slightly higher (32.02 ± 6.85 vs 31.34 ± 6.77 kg/m^2), but the BMI for both groups fell within the obese BMI category (data not shown). This finding is slightly below the national estimate of 42% for obesity in African American

Data reveal that even modest levels of physical activity can reduce breast cancer risk for premenopausal and postmenopausal women.

women aged ≥18 years.[12,13] We found few significant differences in study characteristics when comparing cases and controls for menopausal status, smoking history, and alcohol history. Also, for these variables, tests for associations with breast cancer status were not significant. There were, though, significant differences between cases and controls in the level of vigorous physical activity (P=.010) and total activity (P=.018).

Table 2 displays results of logistic regressions for walking as exercise, vigorous activity, and total activity. Logistic regression results revealed that vigorous physical activity of ≥2 hours per week was significantly associated with a 64% decrease in the risk of breast cancer. There was also evidence that greater hours of vigorous physical activity were associated with larger reductions in the risk of breast cancer (P for trend <.01). On combining walking for exercise and vigorous physical activity to create the MET-hours/week score, there was evidence that participants in the medium and high tertiles had, respectively, 17% and 64% reduced breast cancer risk compared with those in the low tertile. The risk of breast cancer was further assessed separately by menopausal status. Compared with sedentary women, postmenopausal women who participated in vigorous physical activity for ≥2 hrs/wk had an adjusted OR of .38 (95% CI = .14–.99). There was evidence of a nonsignificant association between vigorous physical activity and breast cancer risk for premenopausal women for all levels

Table 1. Distribution of study characteristics by breast cancer status

Variables	Cases (*n*=97) *n* (%)	Controls (*n*=102) *n* (%)	*P**
Age, years	57.63 ± 13.22	52.42 ± 9.93	.002
BMI, kg/m^2			.213
<25	10 (10.3)	18 (17.8)	
25–29	34 (35.1)	27 (26.7)	
≥30	53 (54.6)	56 (55.5)	
Waist-to-hip ratio			.253
<.80	13 (14.0)	17 (17.9)	
.80–.99	78 (83.9)	72 (75.8)	
≥1.00	2 (2.2)	6 (6.3)	
Education level			.350
<High school	10 (10.3)	15 (14.7)	
≥High school	87 (89.7)	87 (85.3)	
Marital status			.003
Single/never married	14 (14.4)	32 (31.4)	
Married	41 (42.3)	23 (22.5)	
Divorced, separated or widowed	42 (43.3)	47 (46.1)	
Income			.434
<$30,000	38 (40.4)	46 (46.0)	
≥$30,000	56 (59.6)	54 (54.0)	
Age at menarche (yrs)			.616
≤12	46 (47.4)	52 (51.0)	
>12	51 (52.6)	50 (49.0)	
Age at 1st full-term birth (yrs)			.289
No births	10 (10.3)	15 (14.7)	
<20	40 (41.2)	50 (49.0)	
20–24	23 (23.7)	15 (14.7)	
≥25	24 (24.7)	22 (21.6)	
Family history of breast cancer			.287
No	68 (70.8)	79 (77.5)	
Yes	28 (29.2)	23 (22.5)	
Menopausal status			.084
Premenopausal	20 (20.6)	32 (31.4)	
Postmenopausal	77 (79.4)	70 (68.6)	
Smoking history			.083
Never	62 (63.9)	54 (52.9)	
Current	8 (8.2)	19 (18.6)	
Former	27 (27.8)	29 (28.4)	
Alcohol history			.093
Never	67 (69.1)	56 (54.9)	
Current	15 (15.5)	27 (26.5)	
Former	15 (15.5)	19 (18.6)	
Walking for exercise, hrs/day			.751
None	26 (26.8)	24 (23.5)	
<2	52 (53.6)	54 (52.9)	
≥2	19 (19.6)	24 (23.5)	
Vigorous physical activity, hrs/wk			.010
None	59 (60.8)	40 (39.2)	
<2	12 (12.4)	19 (18.6)	
≥2	26 (26.8)	43 (42.2)	
Total activity (tertiles)			.018
<15.75	36 (37.1)	27 (26.5)	
15.75–40.24	35 (36.1)	28 (27.5)	
≥40.25	26 (26.8)	47 (46.1)	

Age is presented as mean ± SD.
* P (two-sided) were from t test (for continuous variables) and χ^2 test (for categorical variables).

Table 2. Odds ratios of breast cancer risk in relation to hours of walking for exercise, vigorous exercise, and total activity, overall and by menopausal status

	Walking for exercise (hours/day)		
	None	**<2**	**≥2**
Overall			
Odds ratio*	1.00	.82	.79
95% CI		.38–1.74	.30–2.03
(*P* trend =.576)			
Premenopausal			
Odds ratio†	1.00	.52	1.56
95% CI		.09–2.78	.16–14.37
(*P* trend =.840)			
Postmenopausal			
Odds ratio†	1.00	.93	.61
95% CI		.36–2.44	.19–1.91
(*P* trend =.374)			
	Vigorous exercise(hours/week)		
	None	**<2**	**≥2**
Overall			
Odds ratio‡	1.00	.50	.36
95% CI		.19–1.28	.17–.75
(*P* trend = .006)			
Premenopausal			
Odds ratio§	1.00	.31	.21
95% CI		.01–6.46	.04–1.05
(*P* trend = .025)			
Postmenopausal			
Odds ratio§	1.00	.51	.38
95% CI		.16–1.55	.14–.99
(*P* trend = .032)			
	Total activity (MET-hours/week)		
		Tertiles	
	<15.75	**15.75–40.24**	**≥40.25**
Overall			
Odds ratio‖	1.00	.83	.36
95% CI		.38–1.80	.16–.79
(*P* trend = .009)			
Premenopausal			
Odds ratio¶	1.00	.38	.11
95% CI		.06–2.38	.01–.74
(*P* trend = .020)			
Postmenopausal			
Odds ratio¶	1.00	.88	.33
95% CI		.34–2.25	.12–.88
(*P* trend =.025)			

* Adjusted for age, BMI, family history of breast cancer, age at menarche, age at 1st full-term birth, education, menopausal status, income, and vigorous activity.

† Adjusted for age, BMI, family history of breast cancer, age at menarche, age at 1st full-term birth, education, income, and vigorous activity.

‡ Adjusted for age, BMI, family history of breast cancer, age at menarche, age at 1st full-term birth, education, menopausal status, income, and walking for exercise.

§ Adjusted for age, BMI, family history of breast cancer, age at menarche, age at 1st full-term birth, education, income, and walking for exercise.

‖ Adjusted for age, BMI, family history of breast cancer, age at menarche, age at 1st full-term birth, education, menopausal status, and income.

of activity vs no activity. For total activity, both premenopausal and postmenopausal women in the high tertile (compared with low tertile) had a reduced breast cancer risk (OR = .11, 95% CI = .01–.74 and OR = .33, 95% CI = .12–.88, respectively).

DISCUSSION

We found that vigorous activity levels of ≥2 hours/week were protective of breast cancer among postmenopausal women and high levels of total activity (≥40.25 MET-hours/week) were protective of breast cancer for both premenopausal and postmenopausal women. To our knowledge, only three published studies have addressed this issue in African Americans.[17] Adams-Campbell et al[3] found that high levels of strenuous physical activity during early adult years were associated with reduced relative odds of breast cancer. This study, however, focused only on strenuous physical activity levels. Recently, Bernstein et al[4] examined lifetime recreational exercise activity and breast cancer risk among Black and White women and observed a modest decreasing breast cancer risk associated with increasing physical activity levels averaged over a woman's lifetime. This study, however, also lacked data on the effect of moderate intensity exercise in this population.

Our findings support the association between physical activity and breast cancer risk among African American women. Data reveal that even modest levels of physical activity can reduce breast cancer risk for premenopausal and postmenopausal women. More importantly, the protective effect of physical activity among African Americans was independent of body mass.[17,18]

Table 2. Continued

¶ Adjusted for age, BMI, family history of breast cancer, age at menarche, age at 1st full-term birth, education, and income.

The mechanisms through which physical activity may influence breast cancer development have not been fully elucidated, although several plausible biological mechanisms have been proposed. Because the effect is independent of age and BMI, there is likely a direct influence of physical activity on biological mechanisms.[19] The positive association in premenopausal and postmenopausal women of physical activity and breast cancer risk as well as the inverse association of obesity and premenopausal breast cancer diagnosis[5] suggests a direct biological effect. These mechanisms may include changes in endogenous sex hormones, metabolic hormones, growth factors, central adiposity, and immune functioning.[19] Endogenous estrogens are known to increase risk of breast cancer in both premenopausal and postmenopausal women.[20] Physical activity may affect the risk of endogenous estrogens by reducing production as well as increasing the amounts of sex hormone-binding globulin, which binds to endogenous estrogen and reduces its ability to influence target tissues.[20] Reduced circulating estrogens are reported with increased physical activity in postmenopausal women.[21,22] Regular physical activity also lowers insulin levels, which confer decreased cancer risk.[23] Additionally, physical activity reduces cancer risk by affecting IGFs.[12,24]

Weight control, another important factor, may mediate the effects of physical activity on a woman's breast cancer risk. In fact, the International Agency for Research on Cancer estimates that between one-fourth and one-third of cancer cases are attributed to the combined influence of elevated body weight and inadequate physical activity.[25] Weight distribution, particularly abdominal fat, may contribute to greater risk.[25] Considering African American women have higher rates of obesity, low levels of physical activity may be a significant breast cancer risk factor in this population.

Immune functioning, another biological mechanism, may influence breast cancer risk. Data suggest that blood immune function is positively associated with progression-free and overall survival.[26] Exercise may enhance blood immune functioning by improving natural killer (NK) cell cytotoxic activity, monocyte function, and the proportion of circulating granulocytes.[14,19] While several hypotheses are proposed to explain the pathways between physical activity and breast cancer, more research is necessary to refine our scientific knowledge.

This study focused on an understudied population and breast cancer outcomes. The study also includes other strengths, such as the collection of detailed information about confounding variables (eg, BMI), the use of validated measures for physical activity, and the assessment of both strenuous physical activity and walking. Similar to other case-control studies, the present study has several inherent limitations. First, differential misclassification or recall bias is a potential limitation related to recall bias for cases compared to controls. Overall, however, the lag time from diagnosis to participation in the study was short, which may reduce recall bias. Additionally, cases had a higher participation (70%) than controls (46%), which may have impacted results. There were, however, minimum differences between the two groups in regards to demographic factors.

Because information is limited regarding modifiable risk factors for breast cancer, this study adds to the growing evidence that supports a link between physical activity and breast cancer in African Americans. African American women have higher rates of obesity compared to other ethnic groups, but nationally, only 36% are estimated to participate in vigorous physical activity.[27] A community-based survey of 572 African American members of the African Methodist Episcopal congregation revealed that only 27% of women engaged in moderate or vigorous physical activity.[28] Given the public health significance of this modifiable risk factor, interventions that engage African American women are necessary. More research regarding factors that influence levels of physical activity in African Americans will also aid in developing appropriate intervention strategies.

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AUTHOR CONTRIBUTIONS

Study concept and design: Sheppard, Wallington, Sween, Adams-Campbell
Acquisition of data: Sheppard, Adams-Campbell
Data analysis and interpretation: Sheppard, Makambi, Taylor, Adams-Campbell
Manuscript draft: Sheppard, Makambi, Taylor, Wallington, Sween, Adams-Campbell
Statistical expertise: Sheppard, Makambi, Taylor, Adams-Campbell
Acquisition of funding: Sheppard, Adams-Campbell
Administrative: Sheppard, Sween